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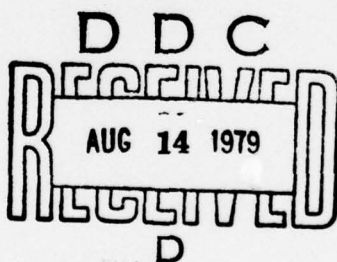
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**DESIGN AND FABRICATION  
OF A TEXTURED HELMET COVER**

by

Alvin O. Ramsley  
William B. Bushnell  
Joe L. Corgan

December 1978



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Contract DAAG17-76-C-0075  
Brunswick Corporation  
Deland, Florida

UNITED STATES ARMY  
NATICK RESEARCH and DEVELOPMENT COMMAND  
NATICK, MASSACHUSETTS 01760



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The shape of the head, neck, and shoulder area of the body is the most characteristic feature in the outline of a person in a field environment. This provides one of the most conspicuous signatures in detection and identification of combat troops. The purpose of this study was to explore an approach toward reducing the signature through the use of a neck shield and a highly textured surface.		

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The report describes the need for such improvement and the design and fabrication of a new helmet cover. It illustrates the concepts intended to meet three principal needs.

1. Alteration of the upper body outline.
2. Improved surface texture.
3. Compatibility of a new laminated helmet.

Part I consists of an introduction and comment by the Project Officers; Part II is the contractor's report, complete with drawings and procedures.

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## PREFACE

In 1976 NARADCOM, as part of its countersurveillance project, initiated a study to develop a helmet cover which to the utmost extent possible eliminates the signature of the head and shoulders of the soldier in the combat environment. A contract, DAAG17-76-C-0075, was negotiated with the Brunswick Corporation of Deland, Florida, to design and fabricate a limited number of camouflage helmet covers which would by its design and color decrease detection by altering and disrupting the head and shoulder outline.

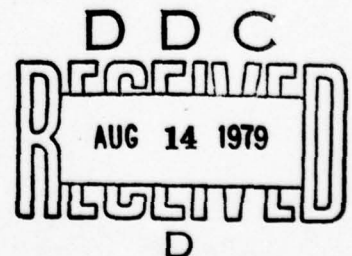
The Project Officer, Mr. Alvin O. Ramsley, and his alternate, Mr. William B. Bushnell, of CEMEL, Countersurveillance Section, modified the original design proposal, resulting in the present configuration for which a patent application has been filed.

This report discusses an important concept of personal camouflage and details the materials, equipment and manufacturing techniques involved in the manufacture of this specific helmet cover design. Photographs and drawings contained within the report further illustrate the helmet cover design and intended function.

This report is presented in two parts; the first by the Project Officers, the second by the contractor.

Specific acknowledgement is due to Messrs. Charles E. Green, R&D Manager and William McClintock of the Brunswick Corporation.

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## EXPERIMENTAL HELMET COVERS

### PART I: PURPOSE AND RESULTS

#### 1. INTRODUCTION

American soldiers and marines have long worn covers over their helmets when in combat or training. The only purpose of a helmet cover has been to provide an added measure of camouflage protection for the head. One effect of the cover is to reduce gloss; a second is to provide a means of attachment of natural materials (twigs, leaves or grass) to enhance camouflage. The main signature (clue to detection) of the upper torso is the distinctive outline provided by the soldier's head, neck, and shoulders. Because it increases the perceived size of the head, a helmet makes this signature even more conspicuous.

The customary way of wearing a helmet cover is to have it snugly fitted to the helmet with no distortion in perceived shape. When worn in this manner with no added natural materials, little, if anything, is done for camouflage of the helmet. The characteristic outline of a soldier's head, neck and shoulder remains. To a substantial degree this appears to be the case whether the helmet cover is patterned or not. As pointed out in Part II, many efforts, following a number of approaches, have been made to design better camouflage for the head. Among these is the approach suggested by Brunswick Corporation who submitted an unsolicited proposal that is the subject of this report. The design provides a rough textured surface to the head and shoulders area that more nearly resembles that seen in nature and also eliminates the characteristic outline. In their original proposal, the design did not extend below the bottom edge of the helmet. Thus, the characteristic silhouette remained, and indeed, became worse because now the perceived head was even larger and the characteristic outline more pronounced than before.

When it was pointed out that provision for concealment of the entire head-neck shoulders outline was necessary, the proposed design was modified to take the form described in detail in Part II. A contract was negotiated with Brunswick Corporation to produce a small number of helmet covers of the modified design.

A second purpose in the design arises from the construction of the new laminated helmet. Helmet covers worn with the steel helmet have been tucked between the liner and the steel helmet; this is not possible with the new laminated helmet. Thus, a modified design is needed in order for a helmet cover to be compatible. Figure 1 shows a comparison of the outlines provided by the present helmet cover and by the design that is the subject of this report.





Figure 1. Comparison of standard helmet and cover with the experimental textured helmet cover.

## 2. OBSERVATIONS AND RESULTS

It is apparent that the new design does better than the old in distorting the characteristic outline of the head, neck and shoulders. The provision for adding natural materials (twigs, leaves or grass) further contributes to the ability of a soldier to conceal his identity by appearing to be a normal part of the scene. Moreover, the highly textured surface more closely resembles the textures observed in nature as can be seen in Figure 2.

The design presented in this report has not yet been adopted for two main reasons. First, a study is in progress on alternative designs. Second, the estimated cost of producing this design may be as much as four times that of a conventional design using woven fabrics. Although the concepts illustrated by this design are valid, the impetus in development will be to implement these concepts in a less costly design.





Figure 2. Textured helmet cover worn with a camouflage patterned uniform with coniferous background.



## PART II.

## FABRICATION OF HELMET COVERS

### 1. SUMMARY

a. In cooperation with the US Army Natick Research and Development Command, Natick, Massachusetts, sixty helmet covers were fabricated. These helmet covers are designed to provide an optimum camouflage for the helmet and head-shoulder profile, while also providing efficiency, adaptability, and convenience.

b. The helmet cover and its attached neck piece were made from an elastomeric fabric. The disruptive elements, which are used to break up the outline, were cut from a spunbonded olefin cloth. All of the components were sewn together by machine. The base cloth and thread were colored to the Forest Green, Federal Standard 595, Number 34079. The disruptive elements were spray painted, conforming in color and near infra-red reflectance to the Forest Green requirements of MIL-E-52798 (ME). The helmet covers have twig retainers so that the disrupter effect can be augmented by the indigenous foliage.

c. The helmet cover is held in place by the elastomeric material and the helmet geometry, one size fits all three of the new helmets, as well as the present issue. When correctly used, the helmet covers create an immediate deterrent to observation by unfriendly forces.

### 2. TECHNICAL DISCUSSION

#### a. Aims and Objectives

The purpose of this work was to manufacture a prototype quantity of camouflage helmet covers. The helmet covers incorporate special techniques for disruption of the geometrical signature of a soldier's head-neck-shoulder profile, as well as incorporating camouflage requirements for visual color and spectral reflectance.

#### b. Background

The individual combat soldier wears a steel helmet as a piece of personal protective equipment. It is designed to protect him from flying projectiles, fragments, and debris. Unfortunately, its relatively smooth and round shape tends to create glint at certain sun angles and provides an unnatural domed silhouette which aids in its detection. The overhanging helmet also casts an undesirable shadow about the neck and lower head area under certain lighting conditions.

Many remedies for these signature problems have been proposed and tested, and some have been used. The most widely used has been a mesh netting stretched over the helmet. Twigs, leaves, and grass were then inserted between the netting and the helmet to serve as camouflage. Helmet covers have also been used which were simply pattern painted cloth covers.

<sup>1</sup> MIL-C-175020, 12/30/71, Cover, Helmet, Camouflage

Incised camouflage cloth, such as is used in netting for field artillery pieces, has also been used to cover helmets. At least on an experimental basis, helmets have been flocked to add extra texture to the otherwise smooth surface. Each of these helmet covers suffers from an assortment of deficiencies.

### c. Statement of the Problem

The primary function of the helmet cover is to disrupt the smooth round profile of the helmet and to backscatter light rays so that glint is not produced. This must be accomplished without incurring the many incidental problems which can prevent the helmet cover from being used. Problems of this nature include too much trouble to carry because of bulk, too difficult to install on the helmet, failure to stay in place, etc. Incised cloth, netting, twigs, leaves, etc., will be snagged by foliage and underbrush. Natural materials which have been inserted between the netting and the helmet will not only be snagged, but likely will be pulled free and lost. The use of twigs, leaves, grass, etc., suffers the additional drawbacks of being dependent upon the individual field soldier's interest and ability to garnish his helmet properly, as well as color changes due to wilting and dying vegetation. Flocked materials cannot be readily applied to or removed from the helmet, but under rough usage tend to come off in spots. The presence of a helmet cover should not be a noise generator either, such as still fabrics or brittle vegetation would be.

## 3. PROCEDURES

### a. Preparation

Sixty camouflage helmet covers were produced as illustrated in the Figures 1 through 15. The manufacturing process consisted of the following tools, equipment, and materials.

#### Tools Used

- Dressmaker shears, 9-inch
- X-acto knife, 6-inch
- X-acto knife blades, #11
- Seam ripper
- Binder clips, #20
- Style 2045 with yellow band, size 14, sewing machine needles
- Pattern tracing wheel
- Straight pins
- Paper stapler with staples
- 12-inch steel straight edge
- Measuring tape, cloth
- Sewing machine oiler
- Soapstone marker



### Equipment

Singer sewing machine Model 252  
Professional buttonholer, Singer  
Cutting table  
Sewing machine table  
Plywood cutting board, 1/2" x 2' x 4'  
Polyethylene board, 1/2" x 2' x 4'  
Twig retainer template  
Stock bins

### Materials

KL665-S HIL, Forest Green #66 fabric  
Size B, Forest Green nylon thread type 2  
Forest Green Enamel, MIL-C-52798  
Sewing machine oil  
Dressmakers tracing paper, white  
Tymar style 3201, Gray 2 oz/yd<sup>2</sup>

### b. Production

Various equipment was acquired by purchase and rental. Modifications were made as required by the particular operational processes. An isolated manufacturing area was set up so that maximum efficiency could be derived from the personnel and equipment involved. After a training program, production began using three sewing personnel and a working supervisor.

Production was performed on a part, component and unit basis with a worker doing the same operation in volume whenever possible for efficiency and reliability.

Cutting of the patterns for the helmet cover halves, neck piece and disruptive elements initiated the work. The cover and neck parts were then marked with a tracing wheel and the materials were cut to size and shape. The twig retainer patches were cut and marked. The disruptive elements were cut.

The disruptive elements were spray painted. Forming of the twig retainers was followed by the dart formation and union of the complementary helmet cover halves. The corona hem and button edge hems were sewn. Sewing of the upper, center and lower disruptive elements was followed by the attachment of the front and back crossed disruptive elements. Inner and edge disruptive elements were sewn on the helmet cover neck shield. The helmet cover and neck piece were sewn together. Spot painting was given to all of the helmet covers as needed to compensate for attrition of the paint caused by the sewing machine pressure foot.

Inspection was performed after all operations to ascertain procedural correctness and to check the final fit on the three helmet sizes. All helmet covers were satisfactory and production was completed on schedule.

#### 4. Problems and Solutions

The initial design was modified to break the shoulder outline more effectively. This was done by extending the neck shield more to the sides.

The paint for the disruptive elements did not have the desired near infra-red reflectance and was replaced by a standard camouflage-Forest Green paint.

One helmet cover when completed did not fit the three helmet sizes. It was salvaged by ripping the seams, discarding the disruptive elements that had been used, and completed by reassembly.

During early production, the helmet cover would slide on the helmet when being pinned. This was remedied by holding it secure with #20 binder clips.

The pinning operation was improved by the use of pedestal type helmet holders which were made from PVC pipe and plywood.

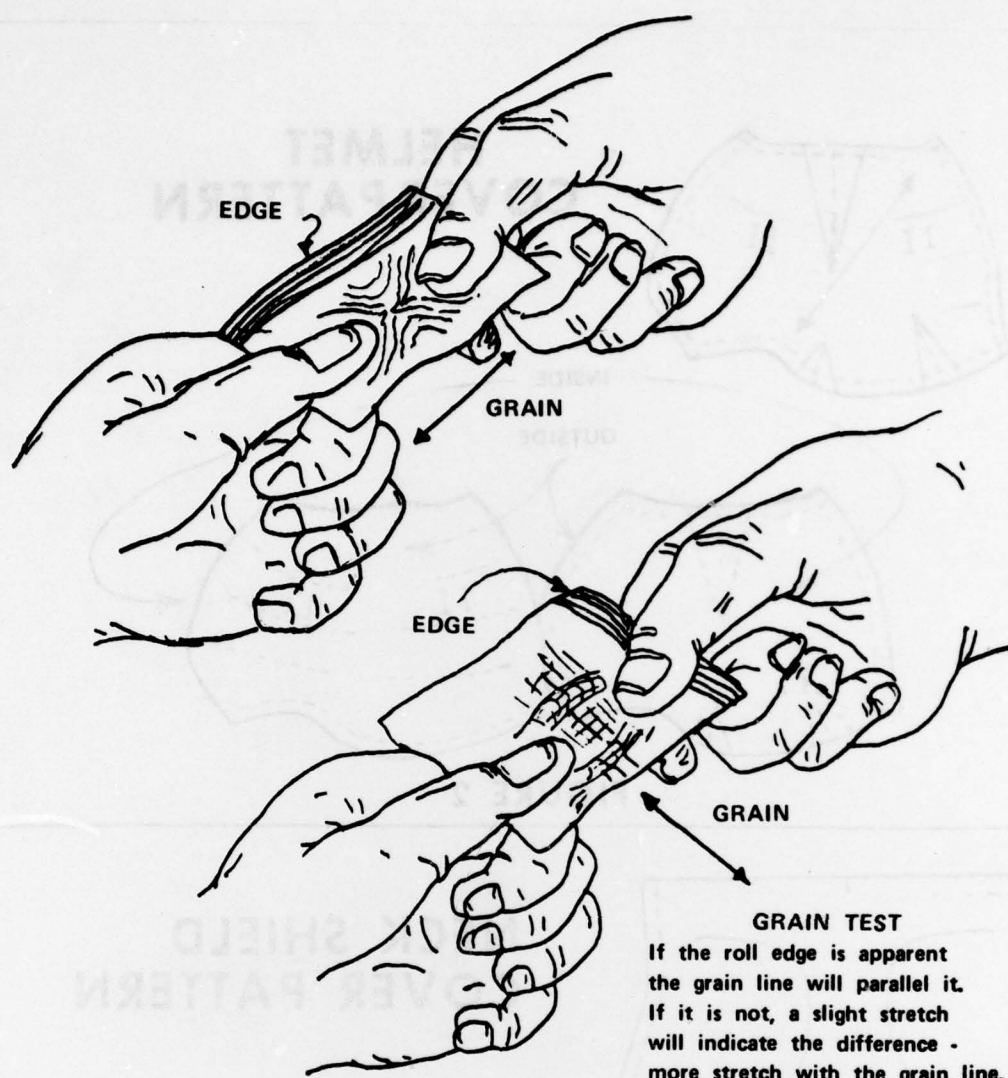
#### 5. Conclusions and Recommendations

Fabrication of helmet covers in volume would be a more efficient and economical operation.

Investigation should be continued for other construction materials for improved coloring and durability.

Individual protective pouches should be provided for carrying the helmet covers in the field.

A variety of helmet cover camouflage colors should be investigated to accommodate the various terrains.



**FIGURE 1**



## HELMET COVER PATTERN

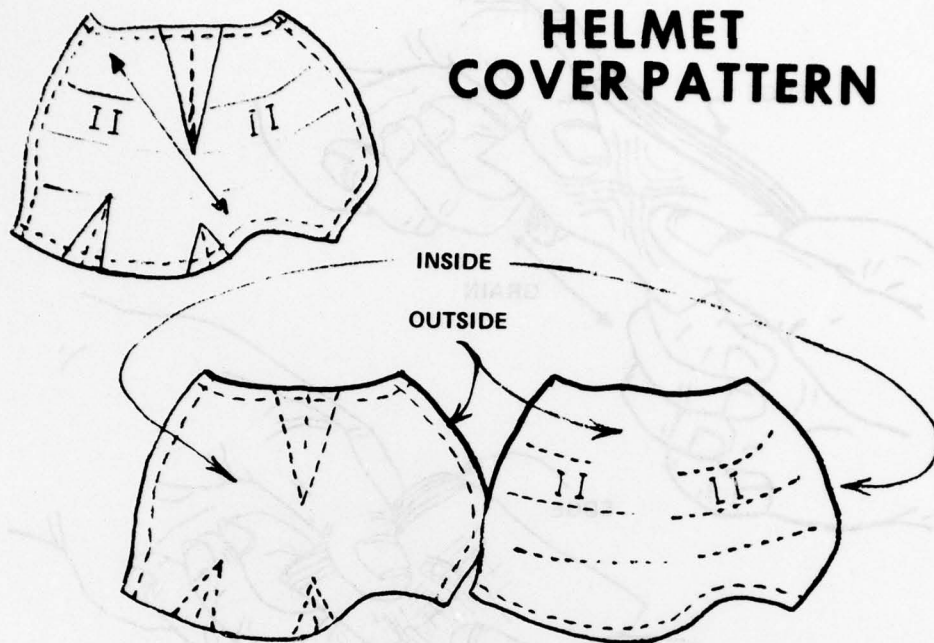


FIGURE 2

## NECK SHIELD COVER PATTERN

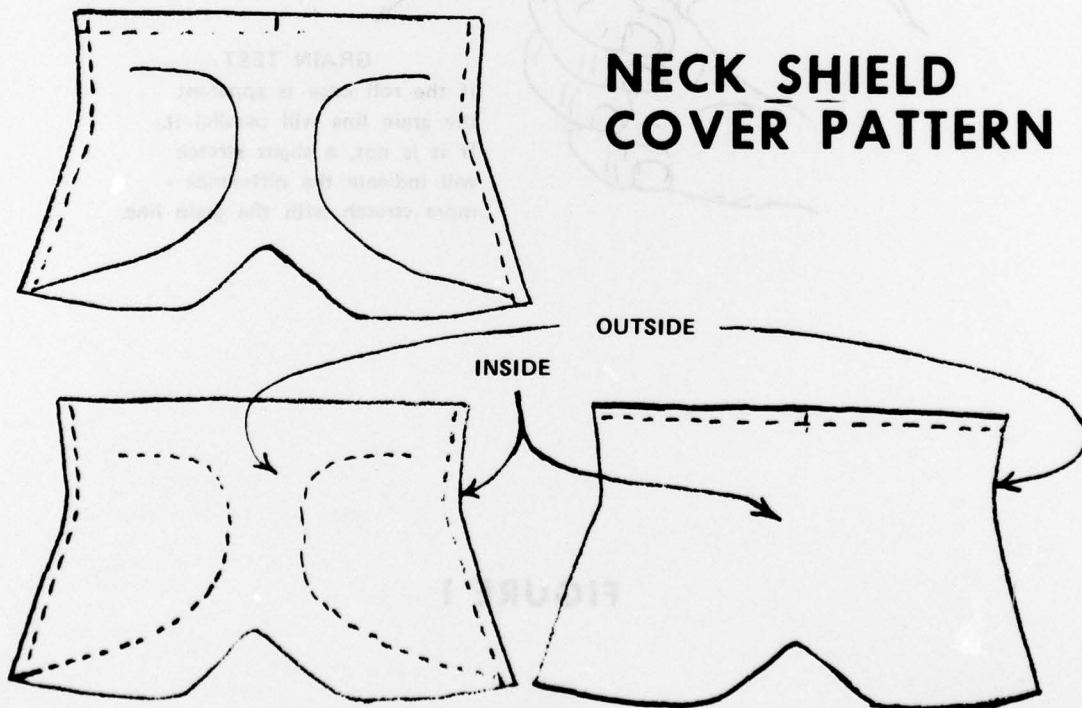
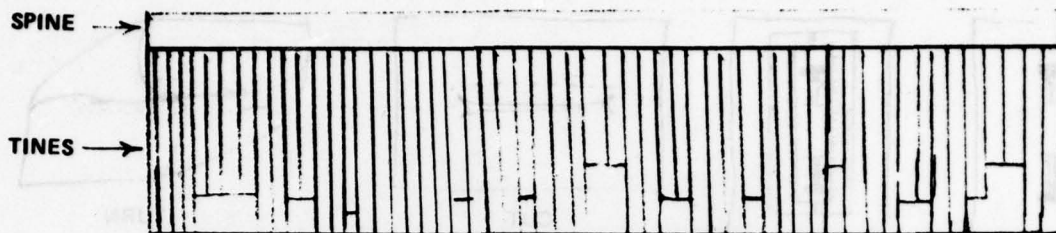


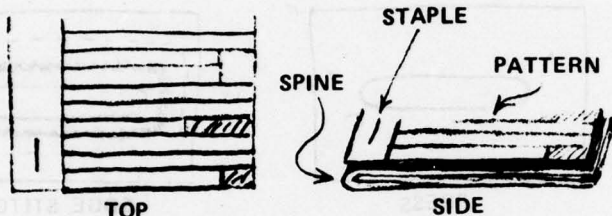
FIGURE 3



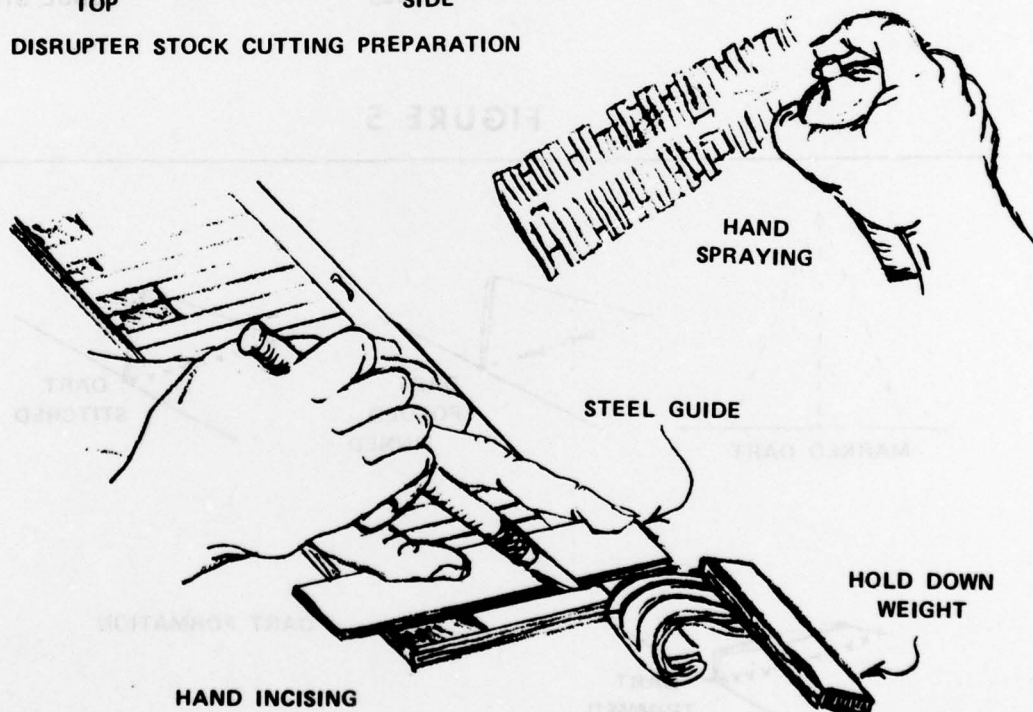


## DISRUPTER - TYPICAL

(PATTERN)

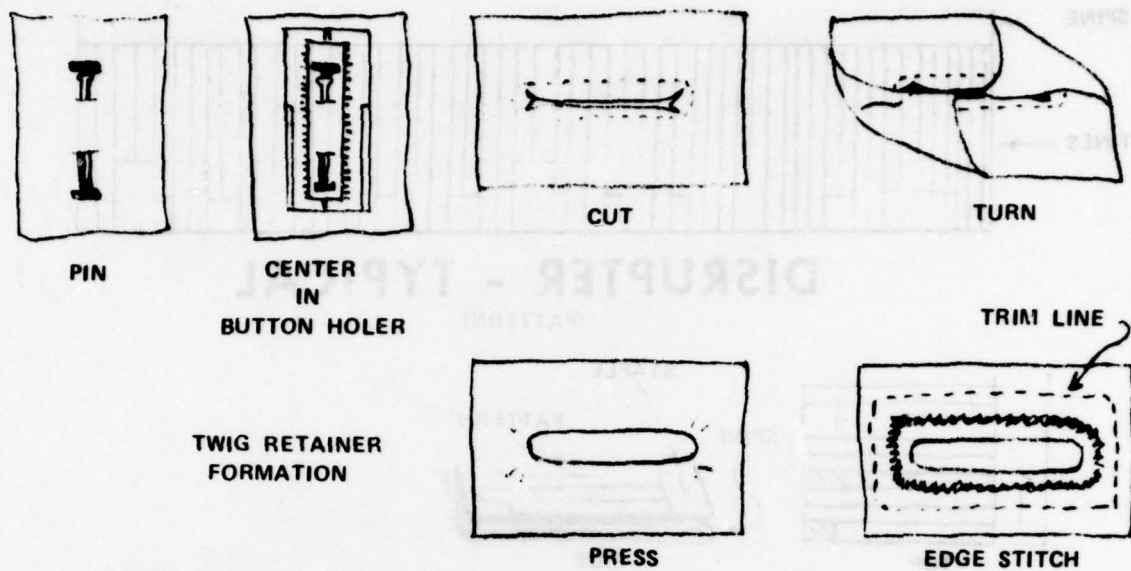


DISRUPTER STOCK CUTTING PREPARATION

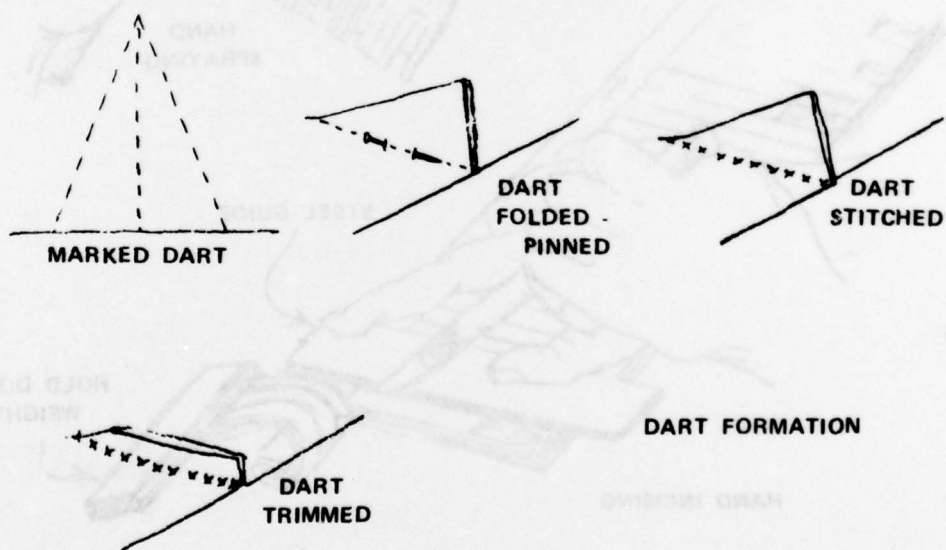


## DISRUPTER PREPARATION

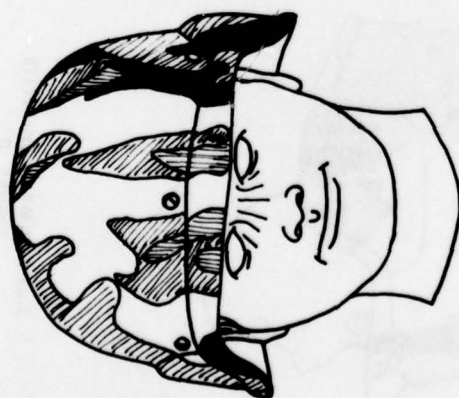
FIGURE 4



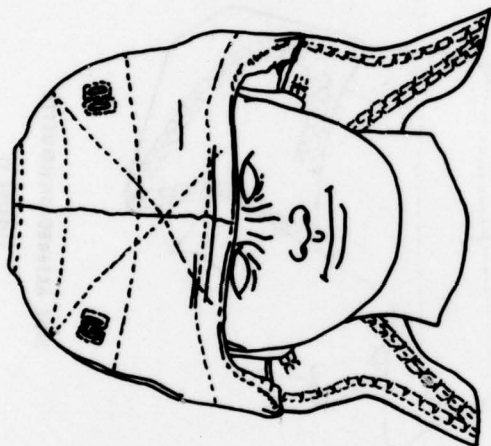
**FIGURE 5**



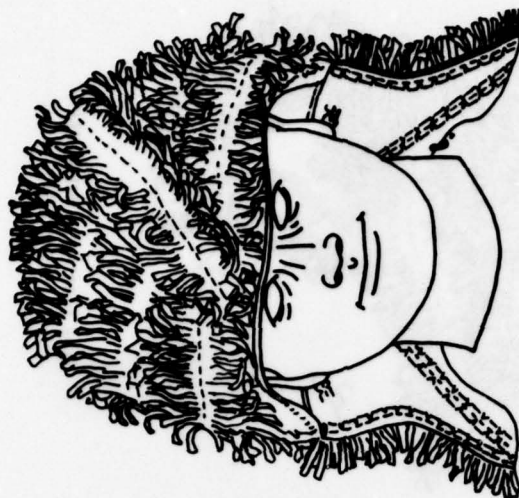
**FIGURE 6**



FRONT NORMAL SILHOUETTE  
FIGURE 7



FRONT ALTERED SILHOUETTE  
FIGURE 8

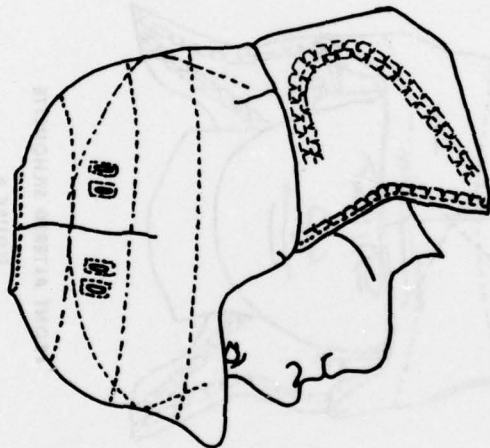


FRONT DISRUPTED SILHOUETTE  
FIGURE 9





SIDE NORMAL SILHOUETTE  
FIGURE 10



SIDE ALTERED SILHOUETTE  
FIGURE 11

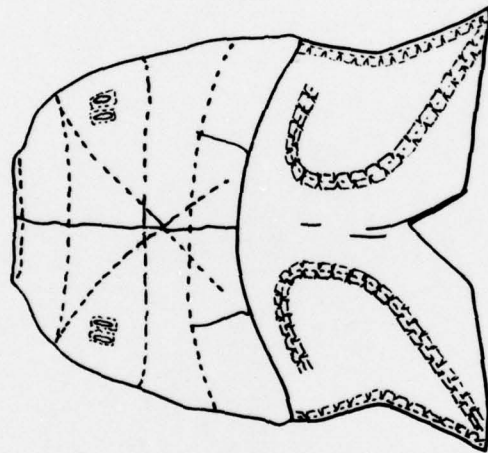


SIDE DISRUPTED SILHOUETTE  
FIGURE 12

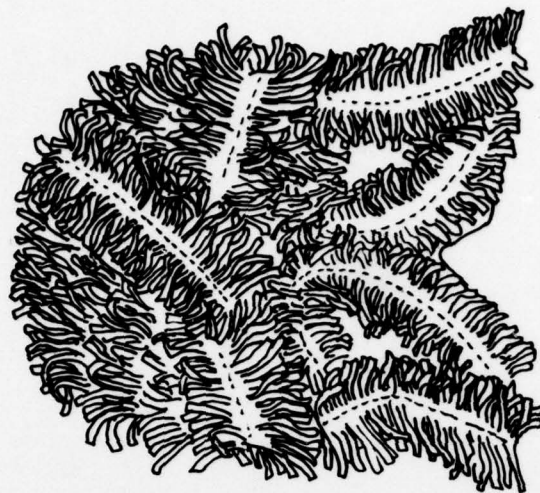




REAR NORMAL SILHOUETTE  
FIGURE 13



REAR ALTERED SILHOUETTE  
FIGURE 14



REAR DISRUPTED SILHOUETTE  
FIGURE 15